ESC201T: Introduction to Electronics

HW -11 **Date: 25.11.2020**

Q.1 Construct a 16 x 1 multiplexer with two 8 to 1 and one 2 to 1 multiplexers. Use block diagrams.

Q.2 Implement the following Boolean function using one 4 to 1 multiplexer and external gates. (Hint: Connect inputs A and B to the control or selection lines of the mux and then use basic gates to apply appropriate combinations of C & D to the input lines of the Mux.) . $F(A,B,C,D) = \sum(1,3,4,11,12,13,14,15)$

Q.3 Show how one can multiply a 4-bit number A with a 3-bit number B using basic gates and a 4-bit adder.

Q.4 Design a circuit that would implement the following function:

IF (A = B) then Y = C + D ELSE Y = C-D. A ,B,C, D are four bit numbers

Q.5 A PN flip-flop has four operations, reset to 0, hold, complement and set to 1 when inputs PN are 00,01,10,11 respectively. Tabulate the characteristic table, excitation table and show how the PN FF can be converted to a D FF.

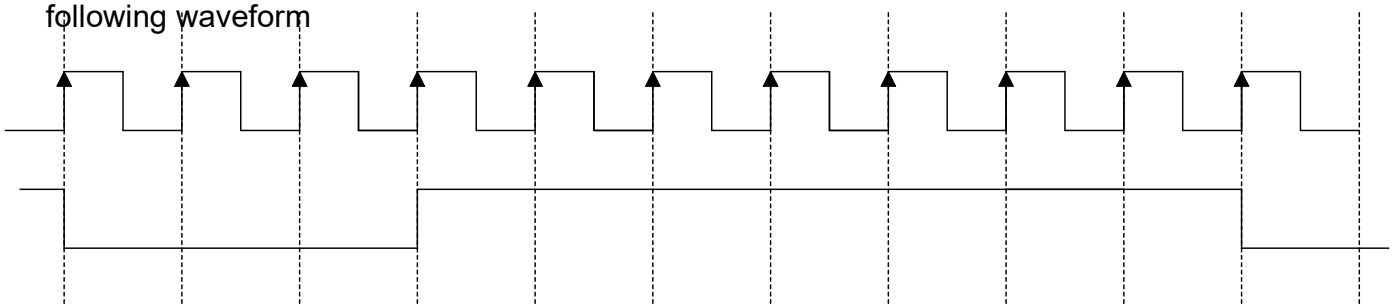
Q.6 A sequential circuit with two flip-flops A and B, two inputs x, y and a output z has the following behavior: $A(t+1) = \bar{x}.y + x.B$; $B(t+1) = \bar{x}.A + x.B$; $z = A$. Draw the logic diagram of the circuit, list the state table and draw the state transition graph.

Q.7 Design a sequential circuit with two D flip-flops A and B and one input x such that when x = 0, the state of the circuit remains the same. When x = 1, the circuit goes through the state transitions from 00 to 01, to 11, to 10 and back to 00, and repeats.

Q.8 Design a synchronous counter that goes through the following repeating sequence 0, 2, 1, 4, 3,6,5,7.

Q.9 Design a synchronous counter using T flip-flops that goes through the following repeating sequence 0, 1,3,7,6,4. Take the unused states as don't care states. Check if the circuit corrects itself if by chance it happens to go to one of the unused states. If not, correct the problem.

Q.10 From a frequency of 10KHz, generate a signal of frequency 1KHz having the following waveform



Q.11 Suppose a 4-bit ripple counter is available with a asynchronous reset input. Show how you can construct a counter which has the count sequence 0-1-2-3-4-5-6-7-8-9-10-11-12-0….